

Risk factors for aseptic bone necrosis following cranioplasty: A multivariate analysis after reinsertion of 500 bone flaps

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Introduction

Autologous bone flap reinsertion after craniectomy follows whenever the cerebral situation has consolidated. However, aseptic resorption of the bone flap still remains a matter of concern (Figure 1). In this study we report on possible perioperative complications in patients undergoing autologous bone flap reinsertion and we identify the risk factors that may predispose to bone flap resorption in these patients.



Typical intraoperative aspect of an aseptic bone flap necrosis

Methods

We included all patients admitted to our neurosurgical department between 09/1994 and 12/2013 in whom a cryoconservated bone flap was reinserted. Clinical and radiological findings were analyzed retrospectively. Flap necrosis was classified into two types (Figure 2). Type II bone necrosis was defined as aseptic resorption with circumscribed or complete lysis of tabula interna and externa requiring surgical revision. To identify predisposing factors a multivariate analysis with bone necrosis type II as the dependent variable was performed.



Classification of bone flap necrosis: type I (a): thinning of the flap, type II (b) circumscribed but complete lysis of tabula interna and externa

Results

Among 457 patients (mean age: 48 years; 59,8% males) who received exactly 500 bone flaps during the observation period, 158 (34,6%) had a diffuse traumatic brain injury, 74 (16,2%) a subarachnoidal haemorrhage, 79 (17,3%) a cerebral infarction, 77 (16,8%) an extraaxial bleeding, 52 (11.4%) an intracerebral bleeding, and 17 (3.7%) had a neoplasm.

Surgical relevant type II bone flap necrosis was diagnosed in 100 patients (21.8%) and 106 bone flaps, after a median time of 15 months (interquartile range [IQR], 10-29).

After multivariate analysis bone flap fragmentation with two (Odds ratio [OR]: 3.9, 95% confidence interval[CI]: 2-7.7, p<0.001) or more fragments (OR: 23.1, 95%CI: 10.1-53,1, p<0.001 and a younger age (OR: 0.97, 95%CI: 0.95-0.99, p<0.001) were associated with a higher risk for the development of an aseptic bone flap necrosis, while size of the flap, time to reinsertion and neurosurgical diagnosis had no significant impact (Table 1).

Table 1		
	Multivariable and	lysis*
	OR (95% CI)	p-value
Age (per year)	0.97 (0.85-0.99)	<0.001
Sex (Female)	1,2 (0,72-2.07)	0.47
Diagnosis		
Diffuse brain injury	Reference	NA
SAH	1.03 (0.47-2.27)	0.93
Cerebral infarction	1.45 (0.61-3.45)	0.4
Tumor	0.98 (0.26-3.68)	0.98
Intracerebral bleeding	1.11 (0.41-3.01)	0.84
Extraaxial bleeding	2.05 (0.83-5.06)	0.12
Time to replacement (month)	0.98 (0.87-1.11)	0.76
Shunt dependent hydrocephalus	1.73 (1 - 3)	0.05
Size (pro 10 cm)	1.03 (0.78-1.38)	0.81
Fragmentation		
No fragments	Reference	NA
2 fragments	3.9 (2-7.7)	< 0.001
>2 fragments	23.1 (10.19-53.1)	<0.001

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NR: not applicable 500 procedures were considered *Hosmer and Lemeshow Chi Square=7.342; p=0.5; Nagel Kerke R Square=0.306

Conclusions

Aseptic bone necrosis remains an underestimated problem after bone flap reinsertion during long-term follow up. According to our data young patients with a fragmented bone flap have an increased risk for aseptic bone flap necrosis. In these cases, an initial allograft should be considered.

References

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